

## ***Musa barioensis*, a New *Musa* Species (Musaceae) from Northern Borneo**

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A new wild banana species, *Musa barioensis* Häkkinen, is described and illustrated, based on observed morphological characteristics in the field. *Musa barioensis* is abundant in the Bario Kelabit highland of Sarawak, East Malaysia and is the only *Musa* species that occurs in the area.

Key words: Borneo, *Callimusa*, *Musa*, *Musa barioensis*, taxonomy, wild banana

Borneo, being part of the primary banana diversity center, has a large number of wild banana species. As banana plants prefer an open exposure, their growth is usually confined to rather small, isolated populations. They consequently manifest much genetic variation. Until the end of the 19th century, the island was covered with dense rain forests (Beccari 1902). Since then, the influence of man such as agriculture, logging, etc. has led to much clearing of the forest, thereby allowing the wild banana populations to expand their growing area.

Bario is one of the most isolated settlements in Sarawak, East Malaysia. There are no roads or rivers connecting Bario to settlements outside Kelabit territory. The only ways into, or out of, Bario are by air in small planes, or by walking for up to ten days. The Bario inter-montane plateau lies in the Kelabit highlands, close to the Indonesian border in Sarawak, with an average altitude of 1,100 m above sea level. The ring of mountains, which are covered with largely untouched sub-montane dipterocarp forest with rich flora and fauna, surround the undulating Bario valley, effectively isolate the plateau from the outside world. The cool-temperate

like climate, averaging 20°C in the Kelabit highlands, has caused a highly diverse indigenous flora and fauna (Hazebroek & Morshidi 2001). Several expeditions have been conducted to enumerate the summit flora in the area but none of them addressed the *Musa* species (Mjöberg 1988, Beaman *et. al.* 1999, Latiff *et. al.* 1999).

An Italian botanist Odoardo Beccari was the first to describe wild bananas from Borneo based on his studies in Sarawak during the period of 1865-68 (Beccari 1902). He described and named four species: *Musa borneensis* Becc., *M. campestris* Becc., *M. hirta* Becc. and *M. microcarpa* Becc. A Japanese Mitsuru Hotta described three new species, *Musa flava* M.Hotta., *M. muluensis* M.Hotta. and *M. tuberculata* M.Hotta based on his expeditions in Sabah, Brunei and Northern Sarawak during 1963-4 (Hotta 1967). N. W. Simmonds, who never visited Borneo, described *M. beccarii* Simmonds from a cultivated plant in Trinidad, which he grew from seeds imported from Sabah (Simmonds 1960). Rusdy E. Nasution, from Herbarium Bogoriense, and Supardiyyono, from Faculty of Biology, National University, Jakarta, described *M. lawitiensis*



FIG. 1. Plant characters of *Musa barioensis* [A-D (M. Häkkinen & K. Meekiong, MK 999)]. A: Semi erects leaf habit and hanging female bud. About 0.2 × in size. B: Petioles. About 0.5 × in size. C: Female inflorescence. About 0.3 × in size. D: Fruit bunch. About 0.4 × in size.

Nasution & Supardiyono (Nasution & Supardiyono 1988). George Argent from Royal Botanical Garden, Edinburgh, described *M. monticola* [Hotta ex] Argent and *M. suratii* Argent from Sabah (Argent 2000).

The author described five varieties of *Musa*

*campestris* Becc., i.e., var. *lawasensis* Häkkinen, var. *limbangensis* Häkkinen, var. *miriensis* Häkkinen, var. *sabahensis* Häkkinen, var. *sarawakensis* Häkkinen and gave notes for the var. *campestris* (Häkkinen 2003, 2004b). Then the author described *M. voonii* Häkkinen (Häkkinen

2004a), *M. bauensis* Häkkinen & Meekiong (Häkkinen & Meekiong 2004), *M. azizii* Häkkinen (Häkkinen 2005), *M. beccarii* var. *hottana* Häkkinen (Häkkinen, Suleimam & Gisil 2005) and six varieties of *M. borneensis* Becc., i.e., var. *alutacea* Häkkinen & Meekiong, var. *flavida* Häkkinen & Meekiong, var. *lutea* Häkkinen & Meekiong, var. *phoenicea* Häkkinen & Meekiong and var. *sarawakensis* Häkkinen & Meekiong (Häkkinen & Meekiong 2005).

This paper is based on field observations made by the author during an expedition to Sarawak in spring 2004. *Musa barioensis* is described as new species and placed in sect. *Callimusa* based on its distinctive morphology (Cheesman 1947, Häkkinen 2004a).

This species is first described based on living plants in the field by completing the entire INIBAP *Musa* Descriptor List (IPGRI-INIBAP / CIRAD 1996). The descriptive terms here also follow the tradition of banana taxonomy as used by Simmonds (Simmonds 1962, 1966). Relevant parts of the specimens were deposited as holotype at the herbarium of the Sarawak Forest Department herbarium Sarawak (SAR) and isotype at the herbarium of Universiti Malaysia Sarawak (HUMS). The complete descriptor list is available at University of Helsinki, Finland, as well as at the aforementioned centre.

***Musa barioensis* Häkkinen sp. nov.** (Figs. 1, 2).  
*Planta gracilis, surculis usque 2, erectis non caespitosis; stipes adultus usque 2.5 m altus, subviridis nitidus, succo aquoso; petiolus ca. 50 cm longus, viridi-flavo, cum parvis ferrugineis maculis, marginibus purpureis alatis stipem amplectens; lamina plusminusve erecta, ca. 140 longa 33 cm lata, oblonga-lanceolata, supra viridis, infra flavo-virens, tristis et sine cera in duobus paginis, basi asymmetrica cum rotundis corrugatis lateribus; inflorescentia pendula deinde fere erecta; pedunculo ca. 30 cm longo, glabro viridique atropurpureis maculis praedito; flores foeminei uniseriati in 6 basilibus nodis per bracteam dispositi; masculinum alabastrum ovoideum, ca. 18 x 14 cm, bracteis imbricatis apice obtusis viridibusque, externe flavis nitidis elineatis, interne flavis pallidis paucissime ceraceis, cum aliquando minimo duobus revolutis bracteis ante cadentem; masculini flores biseriati 8-9 per bracteam, cremei, lobis viridibus pallidis, cadentes cum bractea; infrutescentia laxa, fere erecta, cum 6 manibus, uniseriatis baccis 6 in quoque manu, recurvatis ad pedunculum, ca. 10 cm longis et 2.2 cm in diam., profunde porcatis, apice obtusis, pedicello glabro 1 cm longo; immaturo pericarpio viridi pallido includente pulpam albam; semina numerosa per fructum, cylindrica-obpyriformia, tuberculata rugosaque, sicut in *Musa beccarii*.*

**Typus:** MALAYSIA. Sarawak. Bario. Kelabit highland. 1105 m. alt., latitude 03° 45.466' N., longitude 115° 28.626' E., May 9, 2004. M. Häkkinen & K. Meekiong. MK 999 (Holotype SAR, isotype HUMS).

**Plant** slender, not clumping, suckers maximum 2, vertical close to parent plant. Mature pseudostem up to 2.5 m high, thick 9-12 cm at base, purple-black, underlying colour light green, appearance shiny, sap watery (Fig. 1A). **Leaf** habit semi-erect, petiole yellow green, with small rusty-brown blotches, 50 cm long, petiole canal margins overlapping with wide purple margins, winged and clasping the pseudostem (Figs. 1B, 2D), lamina 140 cm long, 33 cm wide, oblong-lanceolate, upper surface green, lower surface green-yellow, appearance dull and without wax on either surface, very corrugated, leaf bases asymmetric and both sides rounded, midrib dorsally yellow with many purple blotches, ventrally yellow (Fig. 2E). **Inflorescence** at first pendulous then nearly erect, peduncle 30 cm long, 3.5 cm wide, hairless, medium-green in colour with dark purple blotches, first bract sterile, usually 1 with narrow and short foliage leaf, 30 cm long, base broadened, externally dark red, internally pale red, usually

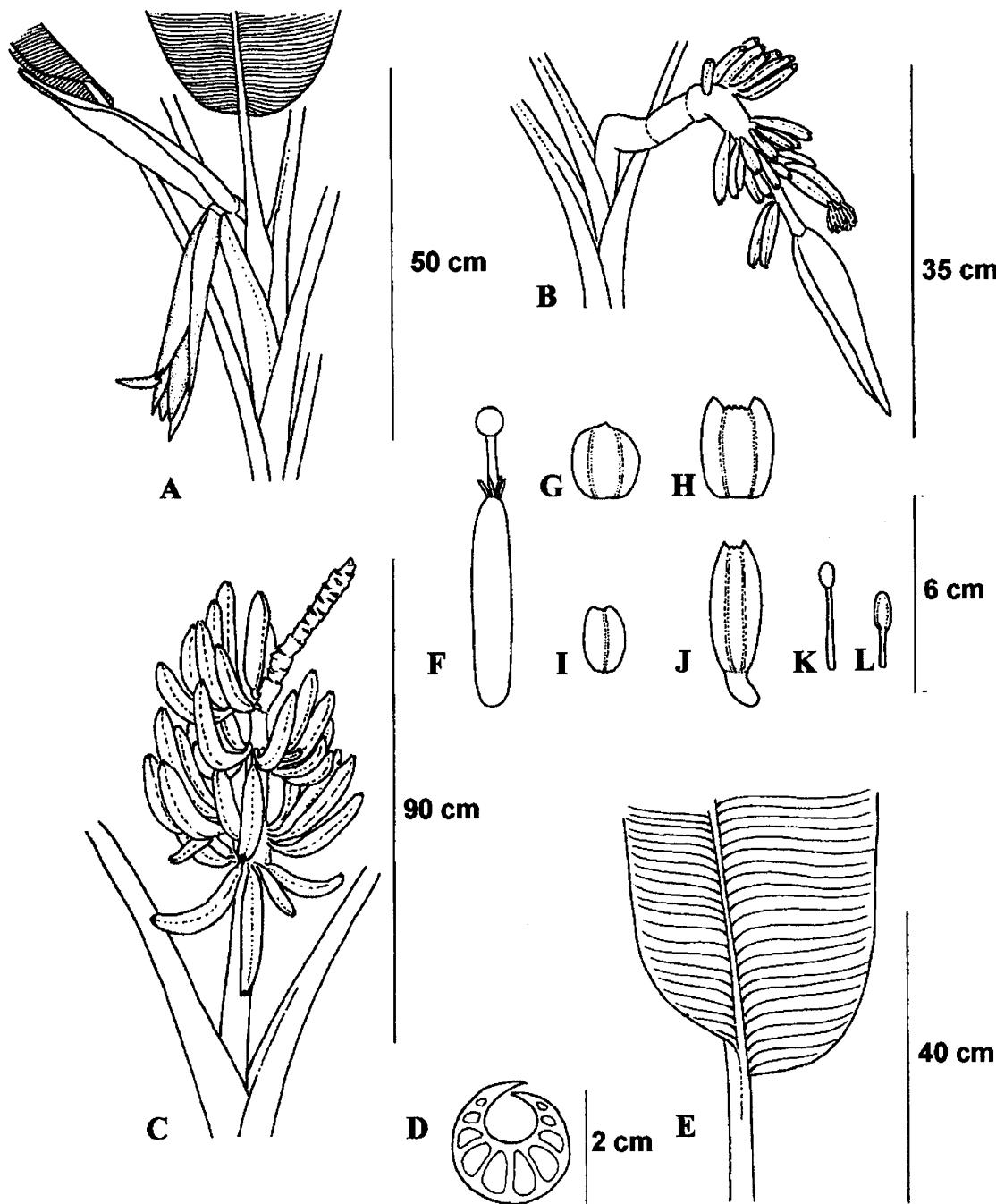


FIG. 2. Drawings of *Musa barioensis* [A-L (*M. Häkkinen & K. Meekiong MK 999*)]. A: The pendulous female bud. B: Inflorescence with male bud. C: Nearly ripe fruit bunch in upright position. D: Cross-section of petiole. E: Leaf base. F-H: Flower parts of female flower: [(F. Ovary, undeveloped anthers, style and stigma. G: Free tepal. H: Compound tepal (tepals removed)]. I-L: Flower parts of male flower: [I: Free tepal J: Compound tepal with sterile ovary (tepals removed). K: Style with stigma. L: Filament with anther].

persistent and rolling back at the opening of the female flowers (Figs. 1A, 2A). **Female bud** lanceolate, 22 cm long, 5 cm wide, apex sharp, externally and ventrally orange-red, with discoloured lines, bract scars very prominent on rachis, one bract lift-

ing at a time, revolute, with very few wax and moderate grooves. **Female flowers** on basal 6 nodes, in a single row per bract, ovary 6.5 cm long, light green, with ovules in four rows per loculus, compound tepal 2.7 cm long with two prominent thick-

ened keels hyaline margins, creamy, lobes light-green, free tepal rounded, 2.2 cm long, translucent white, style 1.9 cm long, persistent, stigma cream, 0.8 cm in diameter (Figs. 1C, 2 F-H). **Male bud** lanceolate 18 cm long, 14 cm wide, bracts imbricate, apex obtuse with green tips, dorsally shiny yellow without discoloured stripes, ventrally pale yellow, with very little wax, lifting two or more bracts at a time and revolute before falling (Fig. 2B). **Male flowers** 8-9 per bract in two rows, creamy, lobes light-green, falling with bract, compound tepal 3.8 cm long, creamy, without pigmentation, apex little developed, ribbed at dorsal angles, free tepal 2.0 cm long, simply folded, translucent white, oval, fertile stamens 5, filaments 1.1 cm long, anthers 1.1 cm long, inserted, white, style white, stigma ivory, ovary 1.0 cm long, arched, whitish green, without pigmentation (Figs. 2 I-L). **Fruit** bunch lax, almost erect with 6 hands and 6 uniserial fruits per hand, fingers curved towards stalk, 10 cm long, 2.2 cm in diameter, strongly ridged, blunt-tipped, pedicel 1.0 cm long, glabrous, immature fruit peel light green, pulp white before maturity (Figs. 1D, 2C). **Seeds** numerous, cylindrical-obpyriform, wrinkled, tuberculate, similar to seeds of *Musa beccarii* in shape and size (Häkkinen 2004a). Chromosome numbers were not counted.

*Notes:* This species has very special habit during flowering. First the female buds are in a hanging position. When the female flower bracts open the inflorescence is horizontal and finally the bunch of fruits is in an upright position

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